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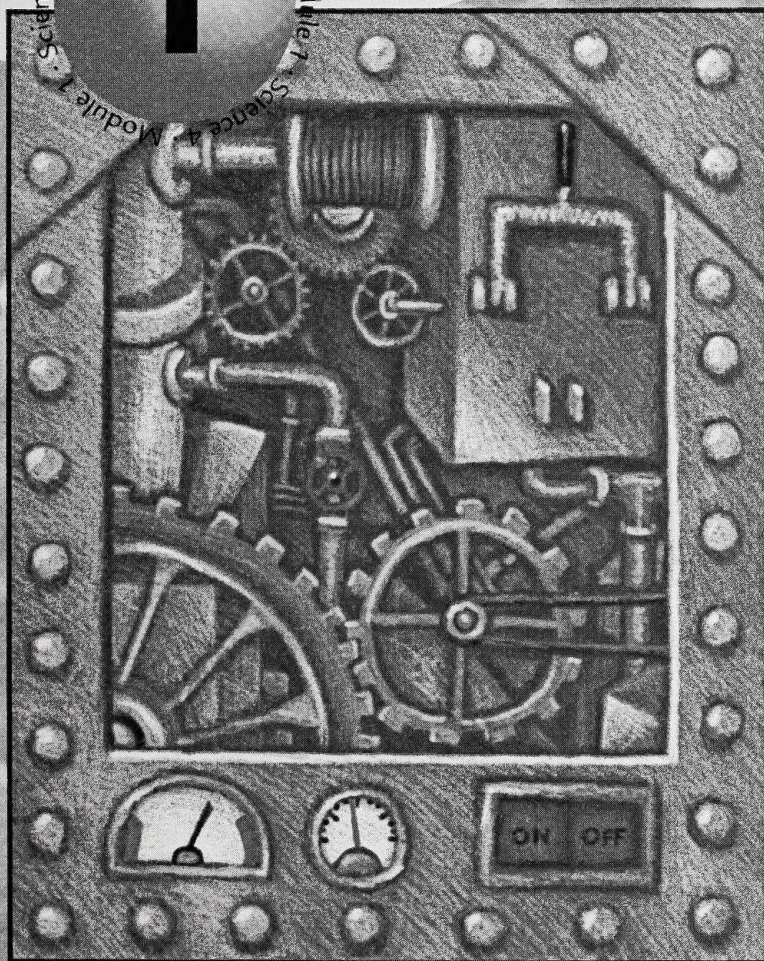


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Science 4

Wheels, Gears, and Levers
Home Instructor's Guide and
Assignment Booklet 1A

Science 4 • Module 1 • Science 4 • Module 1
1



Alberta
EDUCATION



Learning
Technologies
Branch

Science 4
Module 1: Wheels, Gears, and Levers
Home Instructor's Guide and Assignment Booklet 1A
Learning Technologies Branch
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This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	



You may find the following Internet sites useful:

- Alberta Education, <http://www.education.gov.ab.ca>
- Learning Technologies Branch, <http://www.education.gov.ab.ca/lrb>
- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>

Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

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Introduction to Science 4

Welcome to Science 4! We hope that you and your student enjoy working through this course together.

The Course at a Glance

There are six modules for this course.

Module 1

Wheels, Gears, and
Levers

Section 1:

Exploring Simple
Machines

Section 2:

Levers

Section 3:

Drive Systems

Module 2

Building Devices and
Vehicles That Move

Section 1:

Forces That Move Us

Section 2:

A Designer at Work

Section 3:

Building and Refining
the Design

Module 3

Light and Shadows

Section 1:

Light

Section 2:

Exploring Shadows

Section 3:

Twisting, Bouncing, and
Breaking Up

Module 4

Plant Growth and
Changes

Section 1:

Understanding Plants

Section 2:

Adaptable Plants

Module 5

Waste and Our World

Section 1:

Natural and
Human-Made Waste

Section 2:

Pollution Solutions

Module 6

Relationships

Section 1:

Feelings

Section 2:

Being Responsible

Science 4 Curriculum Information

Alberta Education, a department within the Government of Alberta, is responsible for determining what Alberta students are expected to learn from Kindergarten to Grade 12. The department works with its stakeholders to design curriculum and provide authorized resources that meet the needs of learners and educators.

This distance learning course was designed and developed by Learning Technologies Branch within Alberta Education. The course components have been reviewed and approved as provincially authorized resources. This means the Alberta teachers and publishing staff who made these resources have ensured they comply with the standards and specifications established by Alberta Education for this curriculum.

Specific information about this curriculum can be found on the Alberta Education website where Curriculum Handbooks for Parents and Curriculum Summaries are available:

<http://www.education.gov.ab.ca/parents/handbooks/>

Following is a brief summary of the program at this grade level.

Program Rationale and Philosophy

Children have a natural curiosity about their surroundings—a desire to explore and investigate, see inside things, find out how things work, and find answers to their questions. Learning about science provides a framework for students to understand and interpret the world around them. An elementary science program engages students in a process of inquiry and problem solving in which they develop both knowledge and skills. The purpose of the program is to encourage and stimulate children's learning by nurturing their sense of wonderment, by developing skill and confidence in investigating their surroundings, and by building a foundation of experience and understanding upon which later learning can be based.

Elementary and secondary science programs help prepare students for life in a rapidly changing world—a world of expanding knowledge and technology in which new challenges and opportunities continually arise. Tomorrow's citizens will live in a changing environment in which increasingly complex questions and issues will need to be addressed. The decisions and actions of future citizens need to be based on an awareness and understanding of their world and on the ability to ask relevant questions, seek answers, define problems, and find solutions.

The science program of studies is built on the following principles:

- Children's curiosity provides a natural starting point for learning.
- Children's learning builds on what they currently know and can do.
- Communication is essential for science learning.
- Students learn best when they are challenged and actively involved.
- Confidence and self-reliance are important outcomes of learning.

The Science 4 program recognizes that the development of information and communication technology (ICT) skills is fundamental to participation in today's knowledge-based economy. Technology can provide greater access to resources, expose students to real-world problems and authentic contexts for learning, and provide alternative methods of representing and communicating their knowledge.

For further information on the mandated learning outcomes and objectives of the Science 4 program, it is recommended that you visit the Alberta Education website:

http://www.education.gov.ab.ca/k_12/curriculum/bySubject/science/default.asp

Science 4 Course Components

You have chosen an alternative form of learning that allows your student greater freedom in some ways than traditional classroom learning. It also requires discipline and motivation for your student to carry on without someone standing behind and pushing, as a classroom teacher often does. As a home instructor, you can assist your student in many ways. The first thing to do is to familiarize yourself with the structure of the course and its components. The structure of the modules in this course follows a systematic design. The basic components of each module include a Student Module Booklet, Assignment Booklets, and Home Instructor's Guides.

The Science 4 learning package includes the following components:

- six Student Module Booklets
- twelve Assignment Booklets with attached Home Instructor's Guides

When you receive your student's course materials, take the time to look carefully at what you have received to ensure it is complete, that it is the correct course, and that it is not defective in any way. If there is a problem, notify your supplier immediately.

Student Module Booklets

There is one Student Module Booklet for each module. The Student Module Booklet begins with a table of contents, course information, a module overview, and an assessment statement.

The Student Module Booklet contains several lessons to read and activities for the student to do. The lessons in the Student Module Booklet are arranged in sections. The sections contain related lessons and provide the student with additional structure.

It is important that the student read the entire lesson and do all of the practice activities before attempting the assignment for that lesson. Included in some lessons are special sections:

• A Great Scientist

These introduce a great scientist—someone who has made, or is making, a difference to the field of science, in the topic area your student is studying. These people are women and men, contemporary and historical, Canadian and international scientists.

• A Closer Look

These are sections of text containing enrichment ideas relating to the main topic. The purpose of this inset is to offer slightly more complex or detailed information on a topic, or to provide another perspective on the lesson. It is usually an interesting, sometimes humorous, bit of information intended primarily for student interest.

• Imagine

These feature unusual or interesting science facts and information relating to the main text. Scattered throughout the lessons, they are intended for student interest.

If the student gets the rest of the work in the lesson done quickly, he or she can work on these special sections. Try to have the student work on at least a few of these activities. If time permits, the student can work on all of them. Although these activities correspond to the lesson in which the concept is taught, do not restrict the student to working on them only at that time. Once the concept has been covered, the student may work on any of the activities at any time throughout the module. The Student Module Booklet concludes with a Module Summary, which focuses on the main ideas that the student has studied.

The Student Module Booklets are consumable. The student writes directly in the booklets.

Home Instructor's Guides

The Home Instructor's Guides are for the home instructor, the person responsible for guiding the student through the course. It includes planning information and summaries of the lessons, and it offers instructions and directions for ways in which you can support your student. The guide lists Internet website addresses that you and your student might wish to access. Always read the lesson summaries prior to beginning each lesson.

The Home Instructor's Guides are attached to the Assignment Booklets. Separate the two components before the student begins working in the Assignment Booklets.

Assignment Booklets

Accompanying each module are two Assignment Booklets. The assignments in these booklets are designed to help the teacher assess the student's understanding of the concepts covered in the modules. In most instances, your student's marks for each module will be determined by how well he or she does the assignments in the Assignment Booklets. You should confirm with your school if other assessment tools will be used to determine your student's mark for each module. As your student works through a Student Module Booklet, he or she will be directed to complete questions in the appropriate Assignment Booklet. The student should complete the assignments independently. Please ensure that your student follows the instructions in the Assignment Booklets closely and that the student does his or her best work for assessment.

When your student has completed each Assignment Booklet, it should be submitted promptly to the teacher for assessment. It is important to submit assignments regularly. It allows you and the teacher to

- record a current evaluation of the student's progress
- identify strengths and weaknesses
- solve problems as they arise

At the end of each Assignment Booklet, there is a Home Instructor's Feedback Form. This will help the teacher assess the student's learning. The student will also complete a Feedback Form. While you are waiting for feedback from the teacher, you are encouraged to have your student start the next section of the current module or the next module, as applicable.

Information and Communication Technology

Students learn in different ways, and technology helps create different kinds of learning environments. Students have an opportunity to interact with the information. They can try different scenarios and see what happens. They can see how these concepts relate to world problems and situations. Learning information and communication technology (ICT) skills are necessary for your student to ensure ongoing competitiveness in a knowledge-based economy.

If you do not have access to a computer, make every effort to arrange for your student to have periodic access to a computer in a nearby school or library.

Resources and Equipment

In addition to the course materials, your student will need some other resources. Most of them will be things that are found around the home. Try to have all of the materials on hand for your student to complete the activities for a section before he or she begins. Read through the list of materials required for the lessons in the Additional Required Materials section of the Home Instructor's Guide. They are boxed for easy reference.

Following is a list of other equipment that your student will be required to use. You may wish to discuss the availability of equipment with your distance learning provider.

- Your student will need access to a computer with an Internet connection. If you do not have computer and Internet capabilities at home, remember that computers with Internet access are widely available through public libraries and schools. Make arrangements so that your student has access to this valuable resource.

Websites can change or disappear. Your student should keep in mind that the Internet is constantly changing. Sometimes he or she will discover that after typing in an address, a note will come up on the screen indicating that the site has moved or disappeared. If your student finds that an address does not work, he or she should do one of the following:

1. Go to <http://www.archive.org>. Then enter the "missing" URL in the WayBack Machine search on their home page and click the "Take Me Back" button.
 2. Go to one of the search engines and do a general search using a key word or phrase.
- Your student will need a binder to organize returned assignments and teacher feedback.

You may wish to quickly review the Additional Required Materials for each of the modules. Some items are seasonal and you may wish to collect these at the most appropriate time. Other items are used fairly often and may not be readily found at home. Some examples follow.

- You will require garden soil for some activities in Module 5. You may wish to collect some soil (a 4-L pail should be sufficient) before winter. Non-sterilized potting soil is an alternative soil, and again, may be more readily available in the fall. A late spring could make finding soil difficult.
- A magnifying glass is optional, but highly recommended. They are readily available at discount stores (dollar-type stores).
- If your student is particularly keen on investigations and science, you may want to consider purchasing a microscope. Large department stores and toy stores carry microscopes that would be adequate for your student at this age.

Additional Resources

Internet Links

The Internet can be a valuable research and learning tool for your student. Periodically, references to Internet sites are provided in the Student Module Booklets and/or in the Home Instructor's Guides. You should also encourage your student to use other information sources, such as the library.

When your student is using the Internet, there are a few things to keep in mind:

- **Do not believe everything you read.** The Internet is filled with information. Unfortunately, not all of it is correct. Anyone can put information on the Internet. The important thing is that your student takes a close look at the source to determine who is credited with supplying the information. For example, did a university, a museum, or a science centre put the information on the Internet? If so, it probably provides correct information.

The point is to encourage your student to use a critical eye and not to believe everything he or she reads. If your student is uncertain about something, it is wise to double-check the information on one or two other sites or with other resources.

Go to the Internet sites referenced in the Student Module Booklets or this guide before your student accesses them. Confirm the site is still relevant and appropriate for your student. The owners of the Internet addresses (URLs) sometimes change, and a site that was educational when this course was written may no longer be suitable. Also, try out recommended search words to confirm that they are still safe.

- **Use online research tools.** There are a number of different tools, called search engines, available to assist your student in finding information on the Internet. These engines organize and sort information by topic or key word. AltaVista Canada (www.altavista.com), Google Canada (www.google.ca), and Yahoo! Canada (www.yahoo.ca) are just a few of the search engines available.
- **Websites can change or disappear.** Your student should keep in mind that the Internet is constantly changing. Sometimes he or she will discover that after typing in an address, a note will come up on the screen indicating that the site has moved or disappeared. If your student finds that an address does not work, he or she should go back to one of the search engines and do a general search using a key word or phrase.

LearnAlberta.ca

LearnAlberta.ca is a special, protected website found at <http://www.learnalberta.ca>. It has been developed by Alberta Education for Albertans. Whenever your student is asked to go to this large site (portal), you can be assured the content has been either developed by or for Alberta Education or licensed to Alberta Education because it is quality content related to Alberta students' needs.

LearnAlberta.ca is a recognized, digital learning environment for Albertans. This Alberta Education portal is a place where students can support their learning by accessing resources for projects, homework, help, review, or study. Home Instructors also have access so they can learn what their students are expected to know and be able to do. They can then support their students' learning.

For example, LearnAlberta.ca contains a large Online Reference Centre that includes multimedia encyclopedias, journals, newspapers, transcripts, images, maps, and more. The National Geographic site contains many current video clips that have been indexed for Alberta Programs of Study. Teacher support materials and student activities are also available. The content is organized by grade level, subject, and curriculum objective. Use the search engine to find key concepts quickly. Check this site often as new interactive multimedia segments are being added all the time.

If you find a password is required, contact your teacher or school to get one. No fee is required.

The Role of the Home Instructor

As the home instructor, you have a key role in determining your student's success in this course. Your student needs encouragement and the confidence of knowing that the course is important to his or her future.

You are expected to perform the following duties:

- Ensure your student has a suitable study area.
- Ensure your student establishes a timetable.
- Supervise your student's completion of the Science 4 modules.
- Monitor your student's progress.
- Provide your student with encouragement.
- Check your student's work or supervise your student's checking of his or her own work.
- Supervise the submission of Assignment Booklets.
- Develop a routine and a good working relationship with your student. Remember, education is a partnership.

Here are a few other things you can do to help your student maximize his or her chances of success in this course:

- Read the lesson summaries in this guide prior to beginning each lesson. This will acquaint you with the concepts to be taught, the methodology used, and the required materials.
- Encourage your student to read the modules carefully and completely. Students should answer all questions in their Student Module Booklets unless directed otherwise. In some cases it may be appropriate for your student to discuss the questions with you. The student should check his or her responses with the Suggested Answers after he or she has attempted to answer the questions. Encourage your student to discuss his or her answers with you after comparing his or her responses with the Suggested Answers.
- Since developing speaking and listening skills is important, students must be provided with opportunities to work with others. As much as possible, encourage your student to discuss the activities, ideas, and assignments in the course with you or with others.
- Be patient and respectful of the student's way of thinking so that he or she feels comfortable in taking intellectual risks and feels secure when asking questions or forming hypotheses. You also have the critical role of encouraging and challenging the student to become actively involved in the learning process. Set up a rich learning environment that invites exploration and discovery.
- Encourage your student to read as much as possible. As with most other skills, reading improves with practice. In addition to the course materials, students should read stories and magazine or newspaper articles about science.
- The vocabulary of science is quite extensive. You should work with your student to help them pronounce and become comfortable with the new words they encounter. It is important not to overemphasize words at the expense of the important concepts being studied. However, to discuss the studied concepts your student will have to be able to use the appropriate vocabulary.

- Ensure that your student works through each Assignment Booklet slowly and carefully. Most assignments include assessment criteria so that students can see how the assignment will be marked. Review the assessment criteria with your student before he or she begins each assignment. Encourage your student to revise and edit his or her work—assignments should reflect the student's best efforts. As you guide and advise your student, be sure that you do not direct or take control of the work being done. Students must assume responsibility for their work and learn from their mistakes as well as their achievements.
- Review your student's assignments when they have been marked and returned by the teacher. It is natural for the student to make errors and mistakes. Help the student to understand his or her areas of relative strength and weakness and to see where improvements are needed. Try to praise your student's efforts and successes, and give encouragement when he or she is facing challenges.

Arranging the Learning Area

Arrange a quiet area with no distractions to become the permanent “classroom.” You might choose the kitchen or the student's room, or you may have the luxury of a spare bedroom to turn into a learning area. You should have a bookcase, chalkboard or whiteboard, a desk or table to work on, and a bulletin board for displaying student work and learning charts. The side of a refrigerator makes an ideal bulletin board. Proper lighting and comfortable seating are essential. Organizational tools, such as baskets, pails, and filing cabinets, are useful and help keep supplies handy to the work area.

Time Commitment

A well-managed home school begins with a commitment to planning. Long-range planning, weekly goal setting, and day-to-day decision-making will help you gain confidence. Involve the student in the planning where possible.

On a weekly basis, be sure to spend enough time preparing activities, organizing the week's schedule, planning field trips and outings (such as trips to the library), and gathering learning materials and books related to the topic.

Set a definite time period for each science lesson. The suggested time for science is 45–60 minutes per day, five times per week.

Be prepared to modify your plans as circumstances change. Be flexible, but do not procrastinate. A planned approach to module completion will help your student successfully complete the course.

Assessment

Assessment is important to the development of every learner. There are two kinds of assessment in this course: informal and formal. As the home instructor, you will take part in the informal assessment.

Your student will be evaluated using several assessment tools. The teacher will use information from Assignment Booklet questions, writing assignments, and home instructor observations.

Informal Assessment

The Suggested Answers in the Appendix of each Student Module Booklet give students immediate feedback, which confirms and clarifies their understanding before they go on. At the elementary level, monitoring student responses and discussing the results with students is one of the most important duties of the home instructor. When your student has completed an activity, you should skim over it to be sure he or she has spent enough time and effort on the assignment.

When checking your student's work, first focus on the work he or she has done correctly and then comment on his or her efforts. Then, if necessary, spend time clearing up any misunderstandings.

Following are a few suggestions that have proved to be constructive ways of handling errors. First stop to consider why there are errors. Ask yourself the following questions:

- Is the student repeatedly making the same errors, or do the errors appear to be random?
- Do the errors appear to be the result of carelessness?

If your student is repeatedly making the same mistakes, you may need to read through that lesson and explain in your own words what the main ideas are. If the errors are random and do not have a serious impact, then they may be ignored. If the errors appear to be due to carelessness, you may need to

- check to see if your student understands the directions
- relate the activity where the error occurred to some meaningful aspect of your student's life
- discuss the information with your student
- have your student slow down
- give your student a rest

Always instruct your student to correct incorrect responses. The Student Module Booklet becomes an important reference when doing assignments, and it is essential that it is accurate. Remember, it is very important that students not only learn from their corrections, but that they also realize that making mistakes is a normal part of learning.

Formal Assessment

Formal assessment is based on the work students do in their Assignment Booklets, which are marked by a teacher.

There are two Assignment Booklets for each module in the course. The assignments are based on the work the student has completed in the module. Your student may refer to the Student Module Booklet while completing the assignments. Each assignment that is submitted is judged on the basis of the student's demonstrated understanding of the concepts taught in that module, completeness of work, neatness, and legibility.

The teacher will provide written comments and assign a grade at the end of each Assignment Booklet. Discuss the teacher's comments with your student and help her or him set improvement goals. The teacher's comments may help you focus on areas where your student needs extra practice or help. Focus on the student's strengths and support the student in areas of weakness.

After the student's assignments have been reviewed, place them in a binder or other suitable organizer for future reference. You will see growth by comparing present work with previous submissions. Give the student specific praise for effort and apparent improvement. You may want to have your student prepare a display of returned work after each module. It would be a way to show off their work to the whole family.

Special Features

The Student Module Booklet has many special features. Some will help your student move around the material more easily, some provide information, while others are there primarily for student interest. The following are special features of Science 4:

- **Icons:** Several icons appear in the Student Module Booklet. These symbols are cues for your student to do something. Be sure that your student has a clear understanding of what each icon means. The icons are explained in the General Course Information section of Module 1.
- **Key Words:** Key words, or new words, are indicated with coloured, bold-face type. They are defined in the margin on the same page. The new words of the module are also listed alphabetically in the Glossary found at the end of each Student Module Booklet.
- **Internet Links:** Internet links offer extra resource suggestions for many of the activities, relating directly to the topic being studied. They refer the student to a specific site on the Internet. It is important to preview all Internet links to ensure they are relevant and appropriate for your student. Some sites are created with adults in mind; your student may have some difficulty reading the explanations and some assistance may be required.

Notes on the Assignments

The assignment for each section contains several questions. It would be helpful for you to encourage your student to complete the assignment questions as prompted by the cues in the Student Module Booklet.

The follow-up activities are optional. However, if you feel your student would benefit from further content review or enrichment, your guidance would be valuable in helping to select follow-up activities for each module. This can be sent in with the appropriate Assignment Booklet. Although no marks will be awarded, the activity will be evaluated.

Module 1: Wheels, Gears, and Levers

Overview

This module will introduce your student to the basic components of simple machines. He or she will discover the functions that can be performed by inclined planes, gears, and pulleys. Your student will demonstrate a practical understanding of these machines by constructing and using them.

Throughout the module, there are several links to Internet sites. You may want to bookmark these sites, or find them and have the sites available to your student during the time he or she is completing the lesson. Several Internet sites that provide you with further background material will be noted throughout this module. There are many excellent science education sites on the Internet.

For more ideas, you may want to search the following:

- Science Alberta Foundation
<http://www.sciencealberta.org>
- Exploratorium
<http://www.exploratorium.com>

The books *Simple Machines Grades 4–6* by Paul and Clare Reid (S & S Learning Materials, 1998) and *Simple Machines Made Simple* by Ralph St. Andre (Teacher Ideas Press, 1993), *Science Is . . .* by Susan Bosak (Scholastic, 1991), and *How Science Works* by Judith Hann (Reader's Digest book, Dorling Kindersley, 1991) provide lots of easy-to-perform activities on many science topics.

Two good resources for seeing the scientific principles explored in these lessons used in real life are the How Stuff Works website at <http://www.howstuffworks.com> and the book *The Way Things Work* by David Macaulay (Houghton Mifflin). The reading level in the How Stuff Works website is aimed at adults. You may want to visit this site with your student.

Notes to the Home Instructor

This booklet contains the following components for you and your student:

1. Home Instructor's Guide

These are notes for you. First, there is an overview, a listing of suggested websites, and a listing of additional required materials needed for the section. Then, there is an overview of the content, activities, learning outcomes, and special requirements of each lesson in the section.

Note: To ensure that you have all of the materials on hand for your student to complete the activities for each module, read through the list of materials required for the lessons. They are boxed for easy reference, as shown in the following example.

Activity 1: Easy Lifting

- string
- a deck of cards
- an elastic band
- a ruler
- a cookie sheet
- stack of magazines or thin books

2. Assignment Record Form

This is a form to send in with the assignments. Remember to paste the address label provided by your school on it. The teacher will keep track of your student's assignments, record your student's grades, and include his or her comments using this form.

3. Assignment

Your student should answer all questions in complete sentences where possible. Questions set up as lists, tables, charts, or graphs do not need sentence answers. Send the assignment to the teacher as soon as the booklet has been completed.

4. Home Instructor Feedback Form and Student Feedback Form

You and your student should complete these forms. Send them in at the same time as the assignment. They provide us with helpful information about what we are doing right and what needs to be changed.

5. Checklist

The checklist helps you confirm that all of the required components have been collected prior to submitting the completed work to the teacher. For students completing this module electronically, this checklist also includes spaces to indicate the method of submitting graphs, drawings, or photos of assignment work where required.

Section 1: Exploring Simple Machines

Overview

In this section, your student is introduced to several simple machines: inclined planes (including wedges and screws) and pulleys. You may want to encourage your student to collect pictures of these simple machines.

Assessment and Feedback

The feedback you and your student provide in the feedback forms will assist the teacher in assessing your student's progress.

The Section 1 Assignment is worth 36 marks out of a total 92 marks for this module.

Websites Mentioned in Module 1: Section 1

It is recommended that you check these websites prior to your student beginning work on this section.

Lesson 1

- combination locks
<http://www.howstuffworks.com/inside-lock.htm>
- zippers
<http://www.science.howstuffworks.com/zipper.htm>
- Robertson screw and screwdriver
http://www.mysteriesofcanada.com/Ontario/robertson_screws.htm
- faucets
http://www.digitalgizmo.com/projects/proj_faucetDemo.jsp

Lesson 4

- *Mona Lisa*
<http://www.ibiblio.org/wm/paint/auth/vinci/joconde/joconde.jpg>
- pulleys
<http://www.sciencejoywagon.com/physicszone/lesson/otherpub/wfendt/pulleysystem.htm>

Additional Required Materials

Activity 1: Easy Lifting

- string
- a deck of cards
- an elastic band
- a ruler
- a cookie sheet
- stack of magazines or thin books

Activity 2: Easy Roller

- a small cardboard box, such as a shoe box
- rocks, marbles, or other objects to put in the box
- string
- several round pencils

Activity 3: Lifting the Easy Way

- a metal coat hanger
- an empty spool from thread or a sewing machine bobbin
- 2 chairs
- a broom or dowel
- scissors
- 2 m heavy string, cord, or twine
- a plastic bucket with a sturdy handle
- stones, marbles, or other objects
- a ruler
- duct tape or masking tape
- a felt marker
- pliers
- gloves (optional)

Activity 4: Combining Pulleys

- the student's pulley system from Activity 3 (including the chairs, broom, and bucket)
- a metal coat hanger
- an empty spool from thread
- scissors
- 3 m heavy string, cord, or twine
- an elastic band
- a ruler
- duct tape or masking tape
- a felt marker
- pliers
- gloves (optional)

Optional Follow-up Activities

Activity 2: Pulley Power

- 2 brooms
- a long rope

Lesson Summaries

Lesson 1: Inclined Planes

Summary

In Lesson 1, your student studies inclined planes, the first simple machine studied in this section. Inclined planes are ramps or slopes that reduce the force a person needs to exert to raise an object. Encourage your student to visualize lifting a heavy box directly up into the back of a truck. Lifting the box directly up takes a lot of effort; however, it will be completed over a shorter distance. The opposite is true when you use an inclined plane. While the effort needed is less if an inclined plane is used, the effort has to be exerted over a longer distance. This can be taken one step further if your student envisions using an even longer ramp to push the box into the truck. With a longer ramp, the slope will be less steep. This means that the effort is exerted over a longer distance, but it is easier still to push the box. If possible, use a small object to demonstrate these ideas with your student.

Your student would not likely consider a ramp a “machine.” Remind him or her of the definition of a machine (a device that helps perform a task) and then have him or her consider pushing a wheelbarrow of dirt up an inclined plane. Can your student see how an inclined plane is a machine? To illustrate this further, you may want to tell your student that the Great Pyramids were built using inclined planes to move and lift large blocks of stone. (Your student can explore other simple machines used to build the Great Pyramids as an Optional Follow-up Activity to this section.) As well, your student will be better able to see that wedges, axes, and screws are simple machines. These items are related to inclined planes.

In Activity 1: Easy Lifting, your student compares the effort needed to lift a deck of cards directly upwards with the energy needed to lift the deck by using a ramp. It is suggested that he or she attach an elastic band to the deck of cards. However, you may want to have your student use a spring scale. As an extension, you may suggest that your student use an even longer ramp to see if the length of the elastic band changes again.

Encourage your student to look for a variety of screws at home. (For example, threads in a jar lid, a corkscrew, or the end of a light bulb.) The tapered shape and winding inclined plane of a screw allow it to be inserted into other materials. You may want to demonstrate the different effort required to hammer a nail and to twist a screw into a piece of wood. Although screws require more time and effort than nails, their shape creates more friction and holding strength than nails.

Learning Outcomes

It is expected that your student will

- compare the force needed to move an object with and without using an inclined plane;
- be able to describe an inclined plane and to explain how a wedge and screw are types of inclined planes.

Additional Required Materials

Activity 1: Easy Lifting

- string
- a deck of cards
- an elastic band
- a ruler
- a cookie sheet
- stack of magazines or thin books

Lesson 2: Rollers and Wheels and Axles

Summary

In this lesson, your student explores using rollers and wheel-and-axle machines.

In Activity 2: Easy Roller, your student experiments by pulling objects with and without using rollers (pencils). Although this activity does not use a spring scale, your student could use one to measure the force needed to pull the box in each situation. This activity demonstrates how rollers make pulling or pushing an object easier.

In this lesson, your student also studies wheels and axles. Encourage your student to look for wheel-and-axle machines around the home. There are two types of wheel-and-axle machines. Wheels and axles can decrease the amount of effort needed to move an object (called an effort advantage), or they can increase the speed at which an object moves (called a speed advantage). An example of a machine that reduces the amount of effort needed to move an object is a steering wheel. The wheel is large, and it is attached to the axle. The steering wheel makes it easier (effort advantage) to turn the axle. Have your student imagine driving a car without the steering wheel. A car wheel is an example of a machine that increases the speed at which an object moves. The axle rotates the wheel. The wheel has a much larger radius than the axle, causing the car to move quickly.

The amount of force needed to move the object and the speed at which the object moves are both related to the radius of the wheel. (Radius is the measurement from the centre of the wheel to the outside edge of the wheel.) You may need to review how to measure radius with your student.

Learning Outcomes

It is expected that your student will

- understand how rollers and wheel-and-axle machines are simple machines that help move objects

Additional Required Materials

Activity 2: Easy Roller

- a small cardboard box, such as a shoe box
- rocks, marbles, or other objects to put in the box
- string
- several round pencils

Lesson 3: Pulley Power

Summary

In Lesson 3, your student is introduced to pulleys. A pulley is another simple machine. A pulley allows objects to be lifted by pulling down on a rope (in the case of fixed pulleys), rather than lifting the object directly up. For example, imagine lifting a bucket of water using only the bucket handle, and compare it to lifting the bucket by pulling down on a rope. Which would be easier?

You should work with your student in the introductory activity. Help your student find a tree or other place to make an impromptu pulley.

Your student will discover the difference between a fixed pulley (a pulley that is attached to something that does not move) and a movable pulley (a pulley that is attached to something you are lifting). Your student experiments with both types of pulleys in Activity 3: Lifting the Easy Way. Your student will need an adult to help unwind the wire around the “neck” of a wire hanger. The ends of the wire may be sharp, so you could cover the ends with masking tape.

After completing Activity 3, your student should understand that movable pulleys make a task easier; however, there is a trade-off. That is, he or she has to pull the line twice the distance he or she had to pull using a fixed pulley.

Save the pulley system that your student creates in Activity 3. It will be used again in Lesson 4.

Learning Outcomes

It is expected that your student will

- compare the force needed to lift an object with and without a simple pulley

Additional Required Materials

Activity 3: Lifting the Easy Way

- a metal coat hanger
- an empty spool from thread or a sewing machine bobbin
- 2 chairs
- a broom or dowel
- scissors
- 2 m heavy string, cord, or twine
- a plastic bucket with a sturdy handle
- stones, marbles, or other objects
- a ruler
- duct tape or masking tape
- a felt marker
- pliers
- gloves (optional)

Lesson 4: Complex Pulley Systems

Summary

In this lesson, your student builds on his or her understanding of pulleys when studying compound pulleys. Compound pulleys combine the advantages of fixed pulleys and movable pulleys. Each time a rope is turned around a pulley, the “mechanical advantage” (the ease with which the load is lifted) increases. A block and tackle is an example of a compound pulley. Encourage your student to look for examples of compound pulleys in magazines, in the home, and in the community. (For example, sailboats, cranes, curtain or blind “pulls,” and window-washer platforms all use compound pulleys.)

The hands-on nature of this lesson should make the concept of pulleys easy for your student to understand. The websites How Stuff Works at <http://www.howstuffworks.com/pulley.htm> and The Physics Zone at <http://www.sciencejoywagon.com/physicszone/lesson/otherpub/wfendt/pulleysystem.htm> will also help your student understand compound pulleys.

Your student may have difficulty writing a prediction and may need extra guidance. A prediction is a statement of changes likely to happen in an experiment if one variable is changed. For example, “If heat increases, then the ice will melt faster.” Suggest to your student that he or she use the format: “If . . . , then”

Learning Outcomes

It is expected that your student will

- compare the force needed to lift a load using a single pulley system with that needed to lift it using a multiple-pulley system
- state a prediction and a hypothesis

Additional Required Materials

Activity 4: Combining Pulleys

- the student’s pulley system from Activity 3 (including the chairs, broom, and bucket)
- a metal coat hanger
- an empty spool from thread
- scissors
- 3 m heavy string, cord, or twine
- an elastic band
- a ruler
- duct tape or masking tape
- a felt marker
- pliers
- gloves (optional)

ASSIGNMENT BOOKLET 1A

Science 4
Module 1: Section 1 Assignment

Home Instructor's Comments and Questions

Home Instructor's Signature

FOR SCHOOL USE ONLY

Assigned Teacher:

Date Assignment Received:

Grading:

Additional Information:

FOR HOME INSTRUCTOR USE (if label is missing or incorrect)

Student File Number:

Date Submitted:

Apply Module Label Here

Name

Address

Postal Code

*Please verify that preprinted label is for
correct course and module.*

Teacher's Comments

Teacher's Signature

Home Instructor: Keep this sheet when it is returned to you as a record of the student's progress.

INSTRUCTIONS FOR SUBMITTING THIS DISTANCE LEARNING ASSIGNMENT BOOKLET

When you are registered for distance learning courses, you are expected to regularly submit completed assignments for correction. Try to submit each Assignment Booklet as soon as you complete it. Do not submit more than one Assignment Booklet in one subject at the same time. Before submitting your Assignment Booklet, please check the following:

- Are all the assignments completed? If not, explain why.
- Has your work been reread to ensure accuracy in spelling and details?
- Is the booklet cover filled out and the correct module label attached?

MAILING

1. Do **not** enclose letters with your Assignment Booklets. **Send all letters in a separate envelope.**
2. Put your Assignment Booklet in an envelope and take it to the post office and have it weighed. Attach **sufficient postage** and seal the envelope.

FAXING

1. Assignment Booklets may be faxed to the school with which you are registered. Contact your teacher for the appropriate fax number.
2. All faxing costs are the responsibility of the sender.

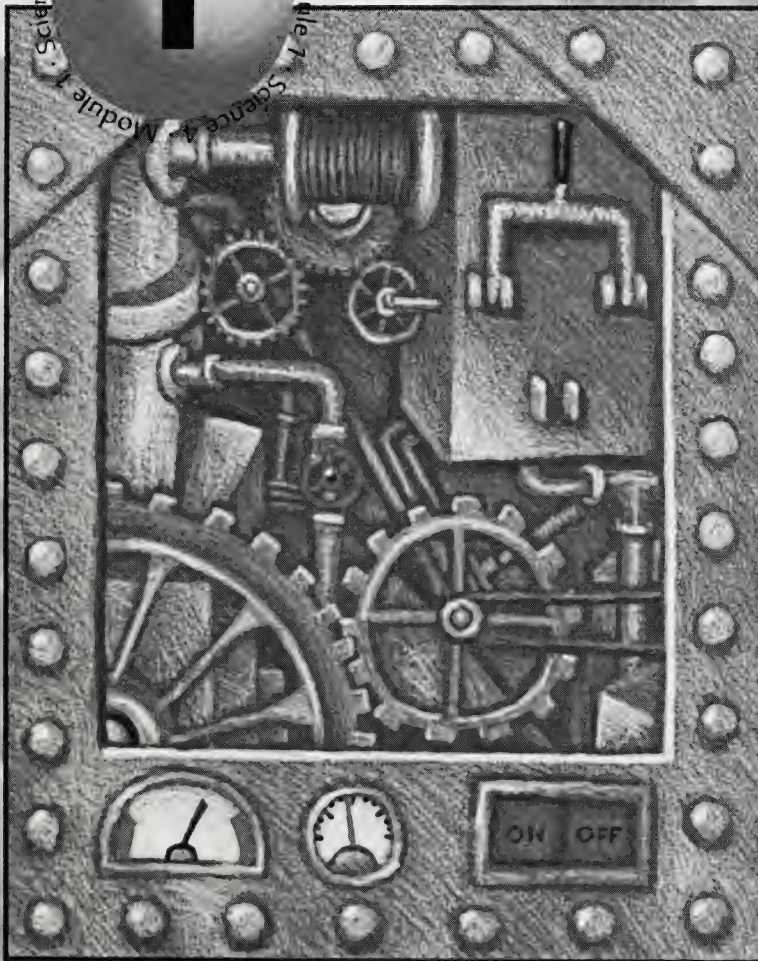
E-MAILING

It may be possible to e-mail your completed Assignment Booklet to the school with which you are registered. You also may be **required** to e-mail some of your assignments. Contact your teacher for the appropriate e-mail address.

Science 4

Wheels, Gears, and Levers Assignment Booklet 1A

1



Alberta
EDUCATION

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Lesson 1 Assignment	7	
Lesson 2 Assignment	12	
Lesson 3 Assignment	8	
Lesson 4 Assignment	9	
	36	

Teacher's Comments

Science 4
Module 1: Wheels, Gears, and Levers
Assignment Booklet 1A
Learning Technologies Branch

The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Assignment Booklet.

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This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	



You may find the following Internet sites useful:

- Alberta Education, <http://www.education.gov.ab.ca>
- Learning Technologies Branch, <http://www.education.gov.ab.ca/lfb>
- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>

Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

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ASSIGNMENT BOOKLET 1A

SCIENCE 4: MODULE 1

SECTION 1 ASSIGNMENT

This Assignment Booklet is worth 36 marks out of the total 92 marks for the assignments in Module 1. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully and record your answers in the appropriate places. If you have difficulty with an assignment, go back to your Student Module Booklet and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

Note: If you are using electronic assignments, you will need to do the following:

- You need to print the pages that ask you to make a drawing. You will find them in your PDF file.
- You will need to mail your drawings to your teacher.

36

Section 1 Assignment: Exploring Simple Machines

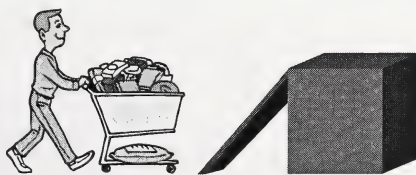
1

1. a. You are pushing a heavy cart. You need to get it on top of a tall box. Which way would you choose? Circle your choice.

Choice 1



Choice 2



Your teacher will look for

- the best choice (1 mark)

③

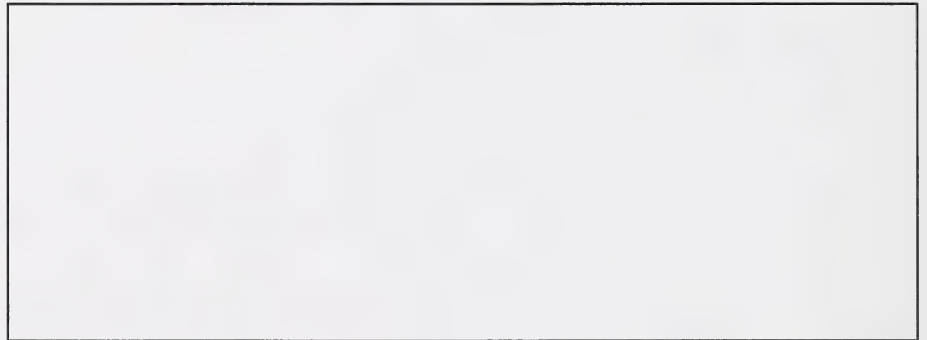
b. Why did you make the choice you did in question 1.a.?

Your teacher will look for

- a clear explanation of your choice (2 marks)
- complete sentences (1 mark)

③

c. Look around your house for an inclined plane. (Wedges and screws will work too.) Describe what you found. Use a diagram to complete your description.



Your teacher will look for

- a carefully drawn diagram (1 mark)
- a clear description of the inclined plane (1 mark)
- complete sentences (1 mark)



When you are ready, turn to Lesson 2 in your Student Module Booklet.

2

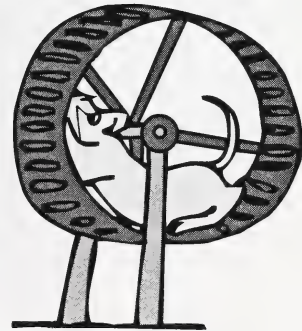
2. a. Think about Activity 2: Easy Roller. Remember how you used rollers (pencils). How did the rollers affect moving the box?

Your teacher will look for

- a clear explanation of how the rollers affected moving the box (1 mark)
- complete sentences (1 mark)

4

- b. Study the pictures of the wheel-and-axle devices below. On each picture, label a **wheel** and an **axle**.



Your teacher will look for

- a wheel labelled in each diagram (1 mark each)
- an axle labelled in each diagram (1 mark each)

2

- c. Refer to the pictures in question 2.b. Complete the following sentences. Use either **wheel** or **axle** in each sentence.

Think about the rear (back) wheel and axle of a bicycle. The effort or force is applied to the _____.

Think about the hamster exercise wheel. The effort or force is applied to the _____.

Your teacher will look for

- the proper word on each blank (1 mark each)

4

- d. Study the hamster exercise wheel in question 2.b. Explain in your own words how the hamster runs the wheel. Use the words **force**, **wheel**, and **axle** in your answer.

Your teacher will look for

- a clear explanation using the words *force*, *wheel*, and *axle* (3 marks)
- complete sentences (1 mark)



When you are ready, turn to Lesson 3 in your Student Module Booklet.

- ② 3. a. Think about Activity 3: Lifting the Easy Way. What role did the spool play?

Your teacher will look for

- a clear explanation of the role of the spool (1 mark)
- a complete sentences (1 mark)

- ③ b. Look at the diagram below. Label the following: **load**, **pulley**, **force**.



Your teacher will look for

- labels in the correct places (3 marks)

3

- c. Remember how a movable pulley makes tasks easier to do. It increases the distance you have to apply a force. At the same time it decreases the force you need to use.

You studied another machine that worked like this. It was earlier in this section. Name that machine. Briefly explain how it helps you to move a load using less force.

Your teacher will look for

- a clear description of the machine (1 mark)
- a clear description of how the machine works (1 mark)
- complete sentences (1 mark)

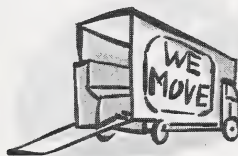
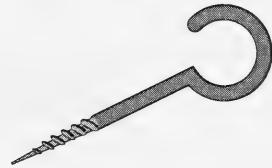


When you are ready, turn to Lesson 4 in your Student Module Booklet.

5

4. a. Look at the pictures of the simple machines. Label each picture, using the names from the following list. You will use each name only 1 time.

- inclined plane
- pulley
- screw
- wheel and axle
- wedge



Your teacher will look for

- proper labelling of each machine (1 mark each)

4

- b. Imagine that you have ordered a new mountain bike for your sister. It arrives in a big, heavy box. You don't want your sister to find out about the bike. You need to move it down the hall and hide it quickly. It is too heavy to move by yourself. There is no one else home to help you.

What simple machine could you use to help you? Describe your choice and how it would help you.

Your teacher will look for

- a clear description of the machine you would use and how it would help you (3 marks)
- complete sentences (1 mark)



Now return to your Student Module Booklet and read the Section 1 Conclusion and Optional Follow-up Activities.

Home Instructor Feedback Form

Module 1: Section 1

Answer the following questions and mail them in with the completed assignment for this section.

1. Did your student have any difficulty with this section? If so, which parts were difficult?

2. Approximately how many of the lessons in this section was your student able to complete within the 45- to 60-minute time frame?

3. Was your student able to easily find the materials for the activities? Indicate any materials that were not readily available.

Please add any questions or comments you may have.

Student Feedback Form

Module 1: Section 1

Answer the following questions and mail them in with the completed assignment for this section. This is not a test, and there are no marks assigned.

1. The Internet was often mentioned in this module as an optional research tool or for optional activities. For the questions below, place an X on the line closest to your answer.

- a. How often did you use the Internet during this module?

not at all		sometimes		often		all the time
<hr/>						

- b. Think about the instructions given in this module. Did they make the Internet easy or hard to use?

very easy		rather easy		neither easy nor hard		rather hard		very hard
<hr/>								

2. What did you find the most difficult in this part of the module?

3. Which version of the Assignment Booklet did you use? Circle the one you used.

Print

Electronic

Checklist for Module 1: Assignment Booklet 1A

Make sure you send in all of the following items.

- ☐ Assignment Record Form
- ☐ Assignment Booklet 1A, questions 1–4
- ☐ Home Instructor Feedback Form
- ☐ Student Feedback Form
- ☐ Optional Follow-up Activity (optional)

If you are completing your assignment electronically, advise your teacher how you are submitting the following:

Question 1.a.: _____

Question 1.c.: _____

Question 2.b.: _____

Question 3.b.: _____

Question 4.a.: _____